PoshBee Toolbox: A portfolio of high quality methodologies, tools, and practice guides for pollinators

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AUTHORS

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KEY MESSAGES

Policies and management practices for managed bees and other pollinators are increasingly reliant on the availability of high quality data in order to inform them. This in turn requires the widespread adoption of state-of-the-art standardised methods and approaches so that new data and knowledge are both robust and trustworthy.

The PoshBee project has developed, tested, and validated a wide range of new tools. These include, but are not limited to:

Experimental protocols: Standardised methods for assessing the multiple risks facing pollinators, such as pesticides, pathogens and poor nutrition.

Monitoring tools: Tools to measure the health of bees (Bee Health Card), monitor pesticides in hives, and models for risk assessments.

Technological tools: Straightforward, practical "how to" tools to support field and laboratory research.

Practice guides: Simple, easy to follow guides with recommendations on a wide range of practical topics.

The wide scale application of these, and other tools will help ensure that researchers, risk assessors, policymakers, beekeepers, and agri-food industry are producing data to the highest standards in a way that increases comparability and transparency. Currently there are a wide range of protocols and other tools being used by different stakeholders with relatively little standardisation across the board.

POLICY RECOMMENDATIONS

- **Policy makers should actively encourage, or legislate for, the adoption of standardised tools at both the national and EU level.** Given the imperative to reverse the decline of pollinators and safeguard sustainable pollination services to both crops and wild plants, robust, high quality data is essential to inform both policy and practice.

- **Policy makers should support the further refinement of PoshBee tools, and the development of new tools.** While PoshBee has greatly increased the current range of tools used for experimental research, risk assessment, and in-field monitoring, there are still many opportunities to extend these to include additional stressors and apply them to a wider range of pollinator taxa.

BACKGROUND AND CONTEXT

Managed bees, including honey bees, some bumble bees, and some solitary bees, are key pollinators of many crops and wildflowers (Potts et al. 2016). Yet, they face serious threats from anthropogenic disturbances including landscape modification, agrochemicals, pests, pathogens and climate change (Dicks et al. 2021). In order to protect bees from these stressors it is critical to be able to understand the health of populations, colonies and individuals. This requires the application of standardised methods and tools to provide high quality, robust and interoperable data which can inform both management and policy responses to mitigate the multiple pressures facing bees.

OVERVIEW OF THE POSHBEE TOOLBOX

Experimental protocols

- **Protocols for assessing impacts of multiple stressors on honey bees, bumble bees and solitary bees in semi-field and field studies**. These provide detailed guidance on the design of studies looking at impacts of stressors on honey bees, bumble bees and solitary bees in the open (field studies) or in large cages (semi-field studies). The stresses include exposure to chemicals (primarily plant protection products); inadequate diet; and exposure to pathogens. The impacts are measured as reduced or altered activity, and increased mortality. (More information here and here, as well as here soon.)

- **Protocols for assessing impacts of multiple stressors of honey bees, bumble bees and solitary bees in the laboratory.** Methods to test the effects (toxicodynamics) of plant protection products (e.g., sulfoxaflor, azoxystrobin and glyphosate), and the toxicokinetics of these agrochemicals in bees across both sexes and castes. (More information in the following PoshBee project reports: D3.2, D4.1, D4.2, D5.2, D6.1, D6.2, D6.3 and D6.4.)

Monitoring tools

- **APISH (Atmospheric Passive Integrated Sampler in Hive).** A cheap and easy-to-use tool to detect bee-related pesticides in honey bee colonies (and in development for bumble bee colonies and in trap-nesting bee nests). (More information here soon.)

- **Bee Health Card (in development).** A simple field tool for bees, that measures chemical exposure, pathogens, immune capacities, and nutritional state. Currently at the prototype stage (TRL 6) but under development as a commercial tool for beekeepers, farmers and researchers as a "traffic light" system (green, yellow and red for low, medium and high impact, respectively). (More information here and in the following PoshBee project reports: D9.1, D9.4, D9.8, D9.9, D9.11, D9.12 and D9.14.)

- **Multi-species environmental risk assessment tool (in development).** A package of landscape inputs and scenarios that allow the use of honey, bumble and solitary bee models in the ALMaSS systems for risk assessments. As well as a bumble bee population model, using realistic landscapes across Europe, providing the basis to develop pesticide risk assessments. The final delivery will be provided to EFSA. (More information here.)

Technological tools

PoshBee has developed a number of new practical tools to help support high quality field and laboratory research. These include:

- Bee Tracker video analysis software for studying solitary ground nesting bee behaviour. (More information here and here.)

- Integrated system for field studies on honey bees. (More information here and here.)

- Bumble bee pollen traps and handling unit. (More information here and here.)

Practice guides

The agricultural European Innovation Partnership (EIP-AGRI) works to foster competitive and sustainable farming, and hosts a library of practice abstracts. PoshBee has contributed 16 abstracts covering laboratory and field studies as well science and stakeholder communication related to managed pollinators. (More information here.)

RESOURCES

Dicks et al. (2021) A global assessment of drivers and risks associated with pollinator decline. *Nature Ecology and Evolution* 10, 1453-1461

Potts et al. (2016) Safeguarding pollinators and their values to human well-being. *Nature* 540, 220-229

Access all of PoshBee's deliverables and papers by scanning the QR code.